The Scottish Mathematical Council

www.scot-maths.co.uk

MATHEMATICAL CHALLENGE 2015−2016

Entries must be the unaided efforts of individual pupils.
Solutions must include explanations and answers without explanation will be given no credit.
Do not feel that you must hand in answers to all the questions.

CURRENT AND RECENT SPONSORS OF MATHEMATICAL CHALLENGE ARE
The Edinburgh Mathematical Society, The Maxwell Foundation, Professor L E Fraenkel, The London Mathematical Society and The Scottish International Education Trust.

The Scottish Mathematical Council is indebted to the above for their generous support and gratefully acknowledges financial and other assistance from schools, universities and education authorities.

Particular thanks are due to the Universities of Aberdeen, Edinburgh, Glasgow, St Andrews, Stirling, Strathclyde and to Bearsden Academy, Kelvinside Academy and Northfield Academy.

Senior Division: Problems 1

S1. I have two blue dice and one red die.
I use the blue dice to play a simple game: if I roll a double six, I win. Otherwise, I lose.
I also roll the red die. If I roll a one, I'll lie about whether I've won or lost the game; if I roll any other number, I'll tell the truth.

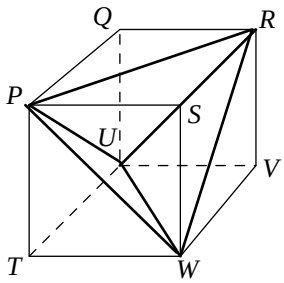
I roll all three dice.
I turn to you and say "I won!".

What is the probability that I did in fact win the game?

S2. A coach travels over a hilly route from town A in the highlands to town B by the coast. Going uphill it travels at 42 mph, going downhill it travels at 56 mph and on level ground it travels at 48 mph. It takes 2 hours and 20 minutes to travel from A to B and 2 hours and 40 minutes to travel back. Find the distance between A and B.

S3. A convex polygon with 12 sides is inscribed in a circle. This polygon has six sides of length $\sqrt{2}$ and six sides of length $\sqrt{24}$ in some order. What is the radius of the circle?

S4. The diagram shows a tetrahedron $PRWU$ which fits snugly inside a cube $PQRSTUVW$.
Find the ratio of the surface area of the cube to the surface area of the tetrahedron .



S5. Let n be a three-digit number and let m be the number obtained by reversing the order of the digits in n. Suppose that m does not equal n and that $n + m$ and $n - m$ are both divisible by 7. Find all such pairs n and m.

END OF PROBLEM SET 1

CLOSING DATE FOR RECEIPT OF SOLUTIONS : 2nd October 2015

Look out for Problems 2 in early December!

Look on the SMC web site: www.scot-maths.co.uk for information about Mathematical Challenge

SMC

Mathematical Challenge Problems 1

SENIOR DIVISION 2015−2016

PLEASE USE CAPITALS TO COMPLETE

SURNAME

OTHER NAME(S) (underline the one you prefer)

SCHOOL

AGE

YEAR OF STUDY S

FOR OFFICIAL USE

Marker

Marks

1	2	3	4	5

Total

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Please write your solutions on A4 paper and staple the above form to them.

PLEASE WRITE YOUR NAME ON EVERY PAGE.

Send your entry through your school to :

David Quinn
School of Mathematics, University of Edinburgh,
James Clerk Maxwell Building, The King's Buildings,
Peter Guthrie Tait Road, Edinburgh EH9 3FD

For further information on the competition, please see the Information Circular, which has been distributed to all secondary schools. Please contact the local organiser, whose name and address are given above, if you require a further copy.